

STUDIES ON THE GERMINATION OF SEED OF PROTEACEAE

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ABSTRACT

Investigations were made of the influence of different treatments on the seed germination of *Protea barbiger*, *P. cynaroides*, *P. eximia*, *P. grandiceps* and *Leucospermum nutans*.

It appears that light has an influence on the germination of proteaceous seed. Seeds of three species, viz., *P. eximia*, *P. grandiceps* and *L. nutans*, germinated best in the dark, while *P. cynaroides* showed the opposite. (The seeds of *P. barbiger* were not treated in the dark.)

Whether germination inhibitors are the cause of dormancy in this family, cannot be decided at present. The highest germination percentages were, however, found when the seeds of the four species were watered with deionised water. This might be an indication of the presence of water soluble inhibitors.

INTRODUCTION

In previously published works (Horn 1962, Thorns 1943, Van Staden and Coetzee 1965, Vogts 1958, 1960 and Werner 1951) the authors have shown that seeds of the South African Proteaceae germinate unsatisfactorily. Vogts (1960) suggested that the dormancy of proteaceous seed is brought about by germination inhibitors, which could be leached out, if the seeds were watered regularly. Horn (1962) on the other hand, did not regard inhibitors as important in the germination of seed of this family. According to him good seed germination may be had with *Protea*, *Serruria* and *Leucospermum* merely by an effective way of sorting the sound from the unsound seed prior to sowing. These conflicting reports have not been proved beyond doubt.

The present investigation deals with the comparative effects of deionised and leached water on the seed germination of five species of the Proteaceae, in light and in the dark.

MATERIAL AND METHODS

Seeds of five species belonging to two genera of the Proteaceae, viz., *Protea* and *Leucospermum*, were examined. Seed of *Protea barbigera* Meisn. was collected in the Klein Swartberg Mountains near Ladismith Cape, that of *P. cynaroides* Linn. near Port Elizabeth, *P. eximia* (Salisb. ex Knight) Fourc. (= *P. latifolia* R.Br.) in the Outeniqua Mountains, *P. grandiceps* Tratt. in the Riviersonderend Mountains, and *Leucospermum nutans* R.Br. near Botrivier. Seeds of all species were collected during 1964. All the seeds used were carefully sorted and only those being plump and able to resist some pressure were sown.

On the 2nd February, 1965, seeds of *P. barbigera* were sown in clay pots (4"). Every pot was heavily coated with bitumastic paint and filled with a fairly uniform, acid-washed sand.

Twenty seeds were sown in each of 24 pots at a depth of approximately one and a half times the diameter of a seed. These were then divided into three groups of eight each. The pots of group one were watered once in four days with 100 ml. of deionised water and those of group two with 100 ml. of leached water (for the duration of the experiment the seeds were watered with the same water, made up to the original volume with deionised water for every watering) and the third group with 100 ml. of a gibberellic acid solution (10 ppm). The pots were kept in the laboratory under light conditions for 92 days, and the number of seeds that germinated, was recorded every four days.

Twenty seeds each of *P. cynaroides*, *P. eximia*, *P. grandiceps* and *L. nutans* were sown on the 28th April, 1965, in each of 16 pots, in the same way as those of *P. barbigera*. The 16 pots were divided into four groups of four each, and were treated, once every six days, with deionised and leached water, under both light and dark conditions. The seed of the proteas was allowed to germinate for 96 days, and that of the *Leucospermum* for 150 days. During this period the temperature in the laboratory was measured with a maximum-minimum thermometer. It varied between 12.2 and 24.4°C for the period shown in Fig. 4. For the period not shown in the figure it never exceeded the above extremes. The number of seeds that germinated, was recorded every six days.

At the end of the experiments the remaining seeds were examined to determine whether they were fertile when sown. By using the total of seeds germinated and those not germinated but with full-grown embryos, the mean germination percentage for each treatment was determined.

RESULTS AND DISCUSSION

Seed of *P. cynaroides* and *P. eximia* started germinating after 24 days, followed by *P. barbigera*, *P. grandiceps* and *L. nutans* which germinated after

TABLE 1

The effect of different treatments on the seed germination of *P. cynaroides*, *P. eximia*, *P. grandiceps*, and *L. nutans*. (All results are expressed as a percentage of the fertile seeds sown.)

	Treatments			
	Seeds watered with deionised water		Seeds watered with leached water	
	light	dark	light	dark
<i>P. cynaroides</i> :				
Mean germination*	31.25	20.00	22.50	18.75
Highest recorded germination	45.00	35.00	35.25	30.25
Lowest recorded germination	25.00	15.50	10.00	00.00
<i>P. eximia</i> :				
Mean germination*	38.75	50.00	41.25	40.00
Highest recorded germination	60.00	64.50	55.00	50.25
Lowest recorded germination	15.00	30.00	29.25	20.00
<i>P. grandiceps</i> :				
Mean germination*	60.00	61.25	57.50	58.50
Highest recorded germination	75.00	80.00	70.00	84.75
Lowest recorded germination	45.00	40.00	50.25	45.00
<i>L. nutans</i> :				
Mean germination*	5.00	6.25	2.50	5.00
Highest recorded germination	15.00	10.00	5.00	10.00
Lowest recorded germination	00.00	5.00	0.25	00.00

* Each value represents the mean of 4 replicates.

28, 30 and 36 days respectively (Figs. 1 to 5). The best germination was recorded for *P. grandiceps* (61.25%) followed by *P. eximia* (50.00%), *P. barbigera* (35.82%), *P. cynaroides* (31.25%) and *L. nutans* (6.25%) (Tables 1 to 2). Germination for *P. eximia* and *P. grandiceps* stopped after 60 days and for

TABLE 2

The effect of different treatments on the seed germination of *P. barbigera*. (All results are expressed as a percentage of the fertile seeds sown).

	Treatments		
	Seeds watered with deionised water	Seeds watered with leached water	Seeds watered with gibberellic acid*
	light	light	light
Mean germination**	30.00	35.82	15.82
Highest recorded germination	55.00	55.00	35.82
Lowest recorded germination	15.00	10.00	5.00

* Solution of 10 ppm.

** Each value represents the mean of 8 replicates.

P. cynaroides six days later. The seeds of *P. barbiger*a and *L. nutans* germinated during the whole experimental period.

As can be seen from Table 1 the seeds of *P. grandiceps*, *P. eximia* and *L. nutans* showed the highest germination percentages in the dark. Only the seeds of *P. cynaroides* germinated well in the light. In 1962 Horn found that seeds of *Protea* germinated under daylight conditions as well as in darkness. He concluded that light is of no importance in the germination of these seeds. The

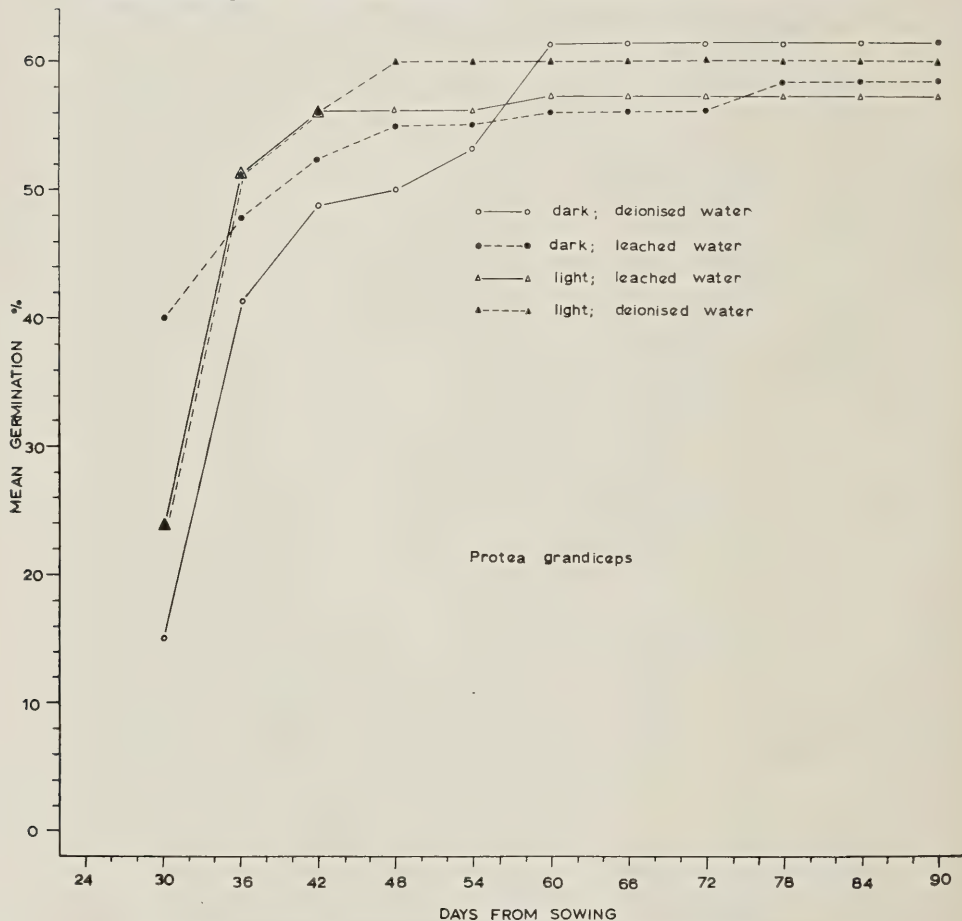


FIG. 1.—Germination rates of seed of *Protea grandiceps* with different treatments.

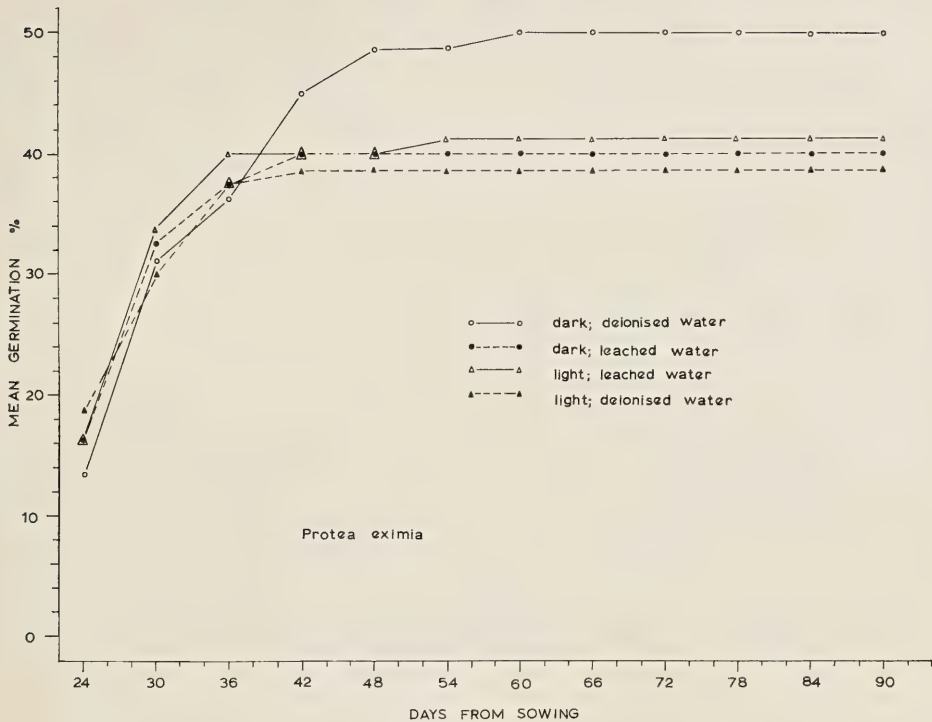


FIG. 2.—Germination rates of seed of *Protea eximia* with different treatments.

present results indicate that light might possibly play a role in the germination of the four species investigated. One must, however, be careful when interpreting the results because of the wide variation found in each treatment. Further experiments are necessary to decide the matter.

Some differences of opinion exist regarding the reasons for the poor germination of proteaceous seed. Vogts (1960) ascribed it to germination inhibitors, and Horn (1962) to ineffective means of separating fertile from infertile seed.

The question of germination inhibitors, if not well diluted, keeping the seeds dormant (Vogts 1960) cannot be decided at present. It is, however, interesting that the highest germination percentages were obtained with seeds watered with deionised water (Table 1). This seems to suggest that water soluble

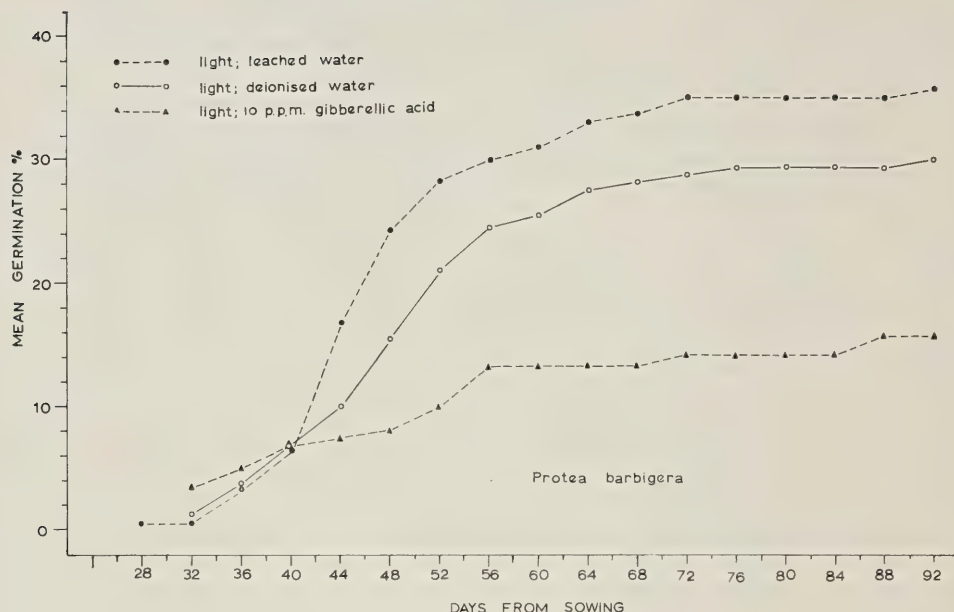


FIG. 3.—Germination rates of seed of *Protea barbigeria* with different treatments.

inhibitors were present in the leached water. No tests were carried out to determine whether this was the case. The situation is somewhat different with *P. barbigeria* where the best germination occurred with leached water (Table 2). Gibberellic acid had only a retarding effect on the germination of this species.

Horn (1962) was of the opinion that the main cause for the poor germination in Proteaceae can be ascribed to ineffective seed-screening methods. In the present experiments and in Horn's (1962) own studies good sorting still gave poor germination percentages. Furthermore, in the present investigations 90% of the seed of *P. barbigeria* which did not germinate had full-grown embryos. In the case of *P. cynaroides*, *P. eximia*, *P. grandiceps* and *L. nutans* the corresponding figures were 95%, 91%, 89% and 76% respectively. These results indicate that the poor germination obtained cannot be ascribed only to ineffective seed sorting and that dormancy must be considered as an important factor.

To solve the different questions further experiments are necessary.

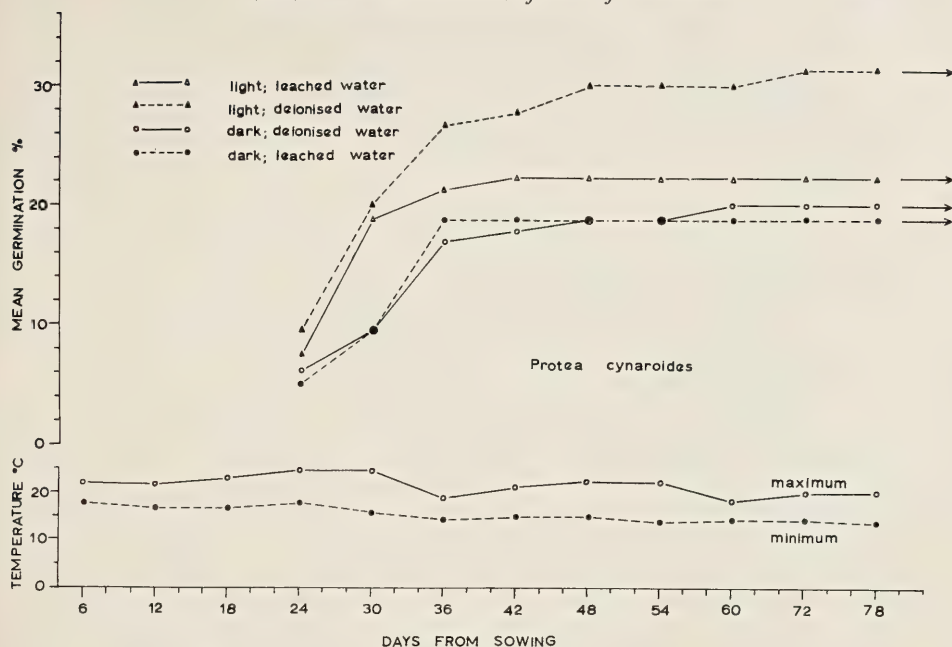


FIG. 4.—Germination rates of seed of *Protea cynaroides* with different treatments. Maximum and minimum temperatures under which the seeds germinated, for 78 days, are also shown.

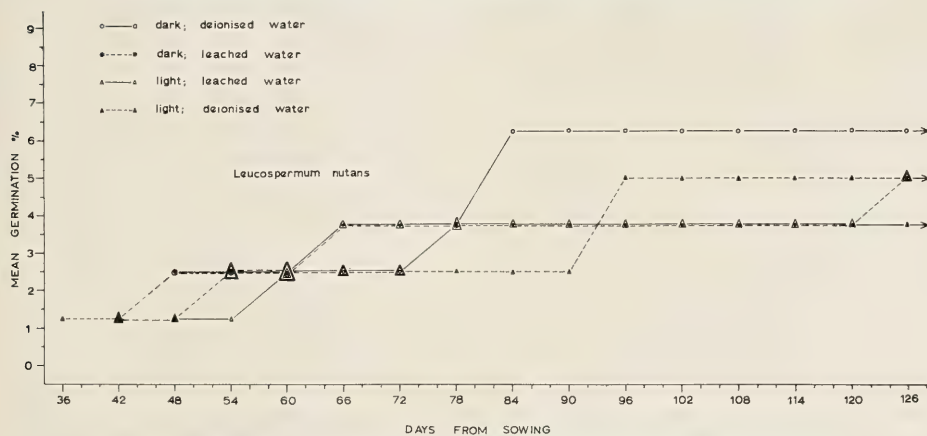


FIG. 5.—Germination rates of seed of *Leucospermum nutans* with different treatments.

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